CHAPTER 4
SYSTEM IMPLEMENTATION

4.1 INTRODUCTION

The most important part of any project i.e., implementation. It describes the various functionalities step by step under each module with their outputs.

4.1.1 CREATE A NETWORK

It is a process to find out mobile infrastructure utilization level of a specific region. The service determination involves the registered user and the non-registered user. The users are classified as follows:

a. **Home User**: The user belongs to the same cluster.

b. **Visitor**: The user belonging to other clusters but utilizing the specified clustered area.

c. **Registered**: The users registered with the service provider and utilizing the same service providers network.

d. **Non registered**: The users are utilizing service from other than their registered service provider.

e. **Others - Home**: They are not the registered users of mobile network but getting the services from the specified clusters.

f. **Others – Visitors**: They are not the registered users of mobile network but getting the service from the clusters other than the specified cluster.
According to the above classification the users are classified as follows:

a. Home-user-registered: registered and utilizing the same network. Example: Aircel Chennai registered user communicating to the same Aircel Chennai mobile.

b. Visitor-user: registered and utilizing the same network in different clusters. Example: Aircel Chennai registered user communicating Aircel network while he is travelling other than Chennai Aircel network. This is normally called as roaming.

c. Home-user-non registered: They are registered with other network and utilizing different network services. Example: A Aircel mobile communicating with non Aircel mobile in Chennai city itself.

d. Visitor–non registered: They are registered with other network and utilizing networks other than their specified cluster. Example: A Chennai based registered Aircel mobile user communicating to other users through service providers other than Aircel.

e. Home others: They are not receiving any mobile network services but connected with network through other communication system from the same cluster. Example: Aircel mobile user communicating to any land line in Chennai itself.
f. Visitor - others: They are not receiving any mobile network services but connected with network through other communicating systems from different clusters. Example: Chennai based registered Aircel user communicating to any land line other than Chennai.

g. Non – registered – visitor: Other network registered users accessing the mobile infrastructure while visiting the specified cluster. Example: non Chennai based other mobile network users communicating to the Aircel mobile network via Aircel network at Chennai.

h. Non – registered- others: Other mobile network non registered users accessing the mobile network infrastructure while visiting the specified cluster. Example: non Chennai based other mobile network users communicating to any mobile network via Aircel network at Chennai.

In this research work the mobile users are observed based on their call transformation via., base cluster . Whenever the call is routed from the same network or from other network and passed through this network; it is encountered as a network utilization system. The initiated call, on going call and passing calls are taken into the account for the service determination. For this process various registers are used to determine the originality of the call. The basic concept of mobile network system and various registers and its functionalities are described as follows:
4.2 Mobile Station

The mobile station (MS) consists of the mobile equipment (the terminal) and a smart card called the Subscriber Identity Module (SIM). The SIM provides personal mobility, so that the user can have access to subscribed services irrespective of a specific terminal. By inserting the SIM card into another GSM terminal, the user is able to receive calls at that terminal, make calls from that terminal, and receive other subscribed services.

The mobile equipment is uniquely identified by the International Mobile Equipment Identity (IMEI). The SIM card contains the International Mobile Subscriber Identity (IMSI) used to identify the subscriber to the system, a secret key for authentication, and other information. The IMEI and the IMSI are independent, thereby allowing personal mobility. The SIM card may be protected against unauthorized use by a password or personal identity number.

4.2.1 Base Station Subsystem

The Base Station Subsystem is composed of two parts, the Base Transceiver Station (BTS) and the Base Station Controller (BSC). These communicate across the standardized Abis interface, allowing (as in the rest of the system) operation between components made by different suppliers. The Base Transceiver Station houses the radio tranceivers that define a cell and handles the radio-link protocols with the Mobile Station. In a large urban area,
there will potentially be a large number of BTSs deployed, thus the requirements for a BTS are ruggedness, reliability, portability, and minimum cost.

The Base Station Controller manages the radio resources for one or more BTSs. It handles radio-channel setup, frequency hopping, and handovers, as described below. The BSC is the connection between the mobile station and the Mobile service Switching Center (MSC).

4.2.2 Network Subsystem

The central component of the Network Subsystem is the Mobile services Switching Center (MSC). It acts like a normal switching node of the PSTN or ISDN, and additionally provides all the functionality needed to handle a mobile subscriber, such as registration, authentication, location updating, handovers, and call routing to a roaming subscriber. These services are provided in conjunction with several functional entities, which together form the Network Subsystem. The MSC provides the connection to the fixed networks (such as the PSTN or ISDN). Signalling between functional entities in the Network Subsystem uses Signalling System Number 7 (SS7), used for trunk signalling in ISDN and widely used in current public networks.

The **Home Location Register (HLR)** and Visitor Location Register (VLR), together with the MSC, provide the call-routing and roaming capabilities of GSM.
The HLR contains all the administrative information of each subscriber registered in the corresponding GSM network, along with the current location of the mobile. The location of the mobile is typically in the form of the signalling address of the VLR associated with the mobile station. The actual routing procedure will be described later. There is logically one HLR per GSM network, although it may be implemented as a distributed database.

The **Visitor Location Register (VLR)** contains selected administrative information from the HLR, necessary for call control and provision of the subscribed services, for each mobile currently located in the geographical area controlled by the VLR. Although each functional entity can be implemented as an independent unit, all manufacturers of switching equipment to date implement the VLR together with the MSC, so that the geographical area controlled by the MSC corresponds to that controlled by the VLR, thus simplifying the signalling required. Note that the MSC contains no information about particular mobile clusters --- this information is stored in the location registers.

The other two registers are used for authentication and security purposes. The **Equipment Identity Register (EIR)** is a database that contains a list of all valid mobile equipment on the network, where each mobile cluster is identified by
its **International Mobile Equipment Identity (IMEI)**. An IMEI is marked as invalid if it has been reported stolen or is not type approved. The Authentication Center (AuC) is a protected database that stores a copy of the secret key stored in each subscriber's SIM card, which is used for authentication and encryption over the radio channel.

- a. The gathered data is represented according to clustering concepts.
- b. The clustered data is used to calculate mobile location.
- c. The standard utilization for the particular instance aid to determine the base station accessibility using user accessibility using algorithm. The graphical representation is also generated for classified users.

4.3 **System Design parameters**

4.3.1 **Network Construction**

The registered mobile users are added in the mobile network construction. The mobile user network cluster also enter with its possible traveling path. The current location and its weighted system adopted.

4.3.1 **Mobile Path**

Each mobile system the home cluster and the path is entered. This is used to identify the current location of the mobile object. This mobile object move from
one cluster to another in the tracking system. The network neighbor algorithm used to find the path of the mobile

4.3.3 Network Weight

All the mobile which is registered and getting service is involved the cost of the service. This service is based on the utilization and existence of the cluster. This cluster position is determined from the access of the cluster and its service. The communication system the cluster has value for the home user and the visited users. The cost between the cluster and the service cost are determined according to the distance. The home and visited user to the cluster in the network predefined.

4.3.4 Packet Traveling

The communication system between the mobile object based on the path. The path may be peer to per or single link process. One node will communicate to another node. But the another system is a broad casting system. Instead of one cluster that will broadcast to all the remaining cluster depends on the request.

The path will be determine depends on the request of the cluster communication or the availability of the infrastructure. The availability is determined using adjacent matrix process in the network.

The neighborhood process cluster and its availability to consider to determine the path specification. Travelling process executed in the specified path.

After determined path using adjacent matrix it adopts the algorithm for packet traveling. During the transmission the distance alone consider to calculate
the cost for this project. The traffic and the size or consider in the uniform value of one in this implementation.

4.4 Screen Shots

The constructed network and its screen shots are represented below:

4.4.1 User Menu Screens

The network created by getting number of mobiles, path limits and path values, which are given by the users.

FIGURE: 4.1
FIGURE : 4.2, 4.3
4.4.2 Network Information

FIGURE: 4.4, 4.5

<table>
<thead>
<tr>
<th>The path limits for 4 mobiles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 3 4 3</td>
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Path values (i.e. traveled clusters) for each mobile

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</thead>
<tbody>
<tr>
<td>3 4 5 0</td>
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<tr>
<td>6 7 8 9</td>
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<tr>
<td>2 3 4 0</td>
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</table>

CLR values for 4 mobiles

| 2 5 0 4 |

Fixed path matrix for mobiles

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<td>4 5 6</td>
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<tr>
<td>7 8 9</td>
</tr>
</tbody>
</table>
4.4.3 Cluster Information

![Cluster Information Image]

**FIGURE**: 4.6, 4.7
4.4.4 Mobile Status

FIGURE : 4.8,4.9
THE DESIGNED SYSTEM HAS FOLLOWING MODULES:

4.5 MODULE 1: PACKET TRAVELING ALGORITHMS

4.5.1 SINGLE LINKAGE ALGORITHM

FIGURE: 4.10, 4.11, 4.12
...POSSIBLE COMMUNICATIONS....

* Mobile 1 to Mobile 2
* Mobile 2 to Mobile 1
* Mobile 1 to Mobile 4
* Mobile 4 to Mobile 1
* Mobile 2 to Mobile 3
* Mobile 3 to Mobile 2
* Mobile 2 to Mobile 4
* Mobile 4 to Mobile 2
* Mobile 3 to Mobile 2
* Mobile 2 to Mobile 3
* Mobile 4 to Mobile 2
* Mobile 2 to Mobile 4

>>

FIGURE : 4.13,4.14
* If source is Mobile 1 and destination is Mobile 2, then packet traveled from mobile 1 to mobile 2
* If source is Mobile 2 and destination is Mobile 1, then packet traveled from mobile 2 to mobile 1
* If source is Mobile 1 and destination is Mobile 4, then packet traveled from mobile 1 to mobile 4
* If source is Mobile 4 and destination is Mobile 1, then packet traveled from mobile 4 to mobile 1
* If source is Mobile 2 and destination is Mobile 3, then packet traveled from mobile 2 to mobile 3
* If source is Mobile 3 and destination is Mobile 2, then packet traveled from mobile 3 to mobile 2
* If source is Mobile 2 and destination is Mobile 4, then packet traveled from mobile 2 to mobile 4
* If source is Mobile 4 and destination is Mobile 2, then packet traveled from mobile 4 to mobile 2
* If source is Mobile 3 and destination is Mobile 3, then packet traveled from mobile 3 to mobile 3
* If source is Mobile 4 and destination is Mobile 2, then packet traveled from mobile 4 to mobile 2
4.5.2 K-MEANS CLUSTERING ALGORITHM

![Image of a software interface with options for create network, network info, cluster info, mobile status, packet traveling, packet scheduling, comparison & recommendations, and exit.](image1)

![Image of a command window with a table labeled 'POSSIBLE COMMUNICATIONS'.](image2)

Communication matrix for mobiles (Row-source, Column-destination)
(1-communication possible, 0-communication not possible)

```
0 1 0 1
1 0 1 1
0 1 0 0
1 1 0 0
```

FIGURE: 4.16, 4.17
FIGURE: 4.18, 4.19
4.6 MODULE 2: PACKET SCHEDULING ALGORITHMS

4.6.1 CONFORMATION OF SOURCES

![Image of menu options]

![Image of command window]

Source and Destinations are confirmed...

......COMMUNICATION STATUS....

Enter the source and destination nodes for checking the communication status...

Enter the source node
1
Enter the destination node
3

communication is possible from mobile 1 to mobile 3 through the path 1 2 3

......CONFIRMATION OF SOURCE & DESTINATION....

Enter the source node
1
Enter the destination node
3

SOURCE NODE : 1
DESTINATION NODE : 3

Source and Destinations are confirmed...

FIGURE : 4.20,4.21
4.6.2 WEIGHTED-DISTANCE SCHEDULING

**FIGURE : 4.22, 4.23**

**Command Window**

```
......WEIGHTED-DISTANCE SCHEDULING...........

HLR(home location register) weight matrix(row-source,column-destination)

Columns 1 through 7

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Columns 8 through 9

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VLR (visitor location register) weight matrix (row-source, column-destination)

Columns 1 through 7

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...CALLCOST FOR FROM SOURCE TO DESTINATION...

Weight matrix for 4 mobiles (for 1 min (i.e. 4 pulses)) (x axis-source, y axis-destination)

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<tr>
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<th>0.6678</th>
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Callcost matrix for 4 mobiles (for 1 min (i.e. 4 pulses)) (x axis-source, y axis-destination)

| 0 | 10.6848 | 6.8112 | 1.0661 |
| 1.6696 | 0 | 10.8640 | 4.6255 |
| 1.4526 | 0.5950 | 0 | 4.0760 |
| 6.1688 | 5.5120 | 10.3616 | 0 |

Callcost for from mobile 1 to mobile 3 = 6.811200

total call cost for 4 mobiles = 63.929123

FIGURE: 4.24, 4.25
4.6.3 GREEDY SCHEDULING

**FIGURE : 4.26,4.27**
4.6.4 WEIGHTED-HOP SCHEDULING
Biograph object with 4 nodes and 8 edges.

Weight matrix for 4 mobiles (for 1 min i.e. 4 pulses) (x axis-source, y axis-destination)

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<td>0.2893</td>
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Callcost matrix for 4 mobiles (for 1 min i.e. 4 pulses) (x axis-source, y axis-destination)

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</table>

Shortest path for travelling from source to destination (based on hops)

1 -> 2 -> 3

Callcost (for 1 min i.e. 4 pulses) for from mobile 1 to mobile 3 = 5.887400

total call cost for 4 mobiles = 10.306681

FIGURE : 4.30, 4.31
4.7 MODULE 3: COMPARISON AND RECOMMENDATIONS

......COMPARISON & RECOMMENDATION......

......calcost for communicate from source to destination....

- In Weighted-distance scheduling : 6.811200
- In Greedy scheduling : 4.350510
- In weighted-hop scheduling : 5.387300

Greedy scheduling is effective,
because it has less cost for communicate from source to destination

Minimum cost for communicate from source to destination : 4.350520

FIGURE : 4.33,4.34
CALL COST GRAPH
(for mobile 1 communicate with mobile 3)

FIGURE : 4.35
The above research work has been done to achieve the following parameters that will enhance effective packet traveling and scheduling for a quality mobile service. The parameters are:

a) Utilization Level.
b) Density and Signal Control.
c) Cost analysis.

a) Utilization Level
In this observation, when the network object nodes are increased, the utilization also increased. The association matrix non-zero element value and network weightage is increased. This shows that the utilization level of the network is increased.

b) Density and Signal Control
This depends on Utilization or capacity of base station and Square Area [Cluster] number of users accessing the service.
Signal control is established by giving priority to home users on First in First Serve basis and other users. By this way, density and signal control is achieved.

c) Cost Analysis
For analyzing the cost, three algorithms are used,
(i) Weighted Distance Algorithm [For billing purpose]
(ii) Greedy Algorithm [Only for Cost Minimization and for rendering best services]
(iii) Weighted hops [For routing purpose]
Out of the three above algorithms discussed, we have suggested for Greedy algorithm as it is able to reduce the cost most effectively and also renders best services for the network.

But, Weighted distance Algorithm is applied for billing purpose as it give appreciated cost for mobile network, which enables the mobile network provider to derive profits and Weighted HOPS is mainly meant for Effective Routing only.

Since the above research is on Analysis of Effective Packet Traveling and Scheduling Algorithm for Quality Mobile Service, it is always best to adopt Greedy Algorithm

5. Conclusion

The research work observed the mobile station data flow and its operation based on the services. The gathered information represented based on the clustering model. The data classified and the cumulative result obtained for the calculation for cluster location and the distance. It is used to determine the decision for the packet travel path and scheduling process.

Learning’s

The researcher learned the concept of Mobile network architecture and its functionality. The researcher identified the demands of the mobile service users
and services of mobile service providers. The concept of the cluster, Network neighborhood process, path determination and traveling process are understood and implemented. The research work leads to learn the technology and its real time implementation.

**Future enhancement**

This research process implemented with the simulated process. This may be incorporated with the real time environment. This process consider only the distance vector cluster and the cost. The traffic, size path routing are to included to determine the efficiency of Quality of Mobile services.

The research work initiated the interest towards the scientific approach of visualizing the real time day to day application. This is the stating point of the research to procure research method and its implementation. The technology learning and its application process will be the continuous process of the researcher and leads the research activity for further level which leads into the higher research and involve the research society.